



The Relationship Between Adma and Anthropometric, Glucose, Lipid, and Inflammatory Parameters in Obese

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Abstract. Asymmetric dimethylarginine (ADMA) is an endogenous inhibitor of nitric oxide production and involved in various pathological processes, especially processes involving cardiovascular risk. The purpose of this study was to analyze the correlation between ADMA and anthropometric, glucose, lipid, and inflammatory parameters. The study was analyzed by a cross-sectional study of 45 obese subjects at H. Adam Malik Hospital. Blood tests were carried out after 8-10 hours of fasting against cardiovascular risk: anthropometry (body weight, BMI, and WC), glucose (FPG, PPS, HbA1C, Fasting Insulin, and HOMA-IR), lipid (LDL-C, HDL-C, TG, and sd-LDL), and inflammation (ApoB and hs-CRP) parameters. The results showed of the 45 subjects, the average age was 41.69 ± 5.69 years old, and the average BMI was 33.09 ± 5.05 (Obesity I). ADMA was also found to be correlated significantly with FPG, HbA1c, and TG parameters [$r = -0.506$, $p = 0.001$; $r = -0.334$, $p = 0.013$, dan $r = -0.315$, $p = 0.017$, respectively]. In obesity, ADMA correlated significantly with cardiovascular risk parameters: FPG, HbA1C, and TG.

Keyword: ADMA, Obesity, Cardiovascular risk factor

Abstrak. Asymmetric dimethylarginine (ADMA) adalah penghambat endogen dari produksi oksida nitrat dan terlibat dalam berbagai proses patologis, terutama proses yang melibatkan risiko kardiovaskular. Tujuan dari penelitian ini adalah untuk menganalisis korelasi antara ADMA dan parameter antropometrik, glukosa, lipid, dan inflamasi. Penelitian ini dianalisis dengan studi cross-sectional pada 45 subyek obesitas di Rumah Sakit H. Adam Malik. Tes darah dilakukan setelah 8-10 jam puasa terhadap risiko kardiovaskular: antropometri (berat badan, BMI, dan WC), glukosa (FPG, PPS, HbA1C, Insulin Puasa, dan HOMA-IR), lipid (LDL-C, Parameter HDL-C, TG, dan sd-LDL), dan peradangan (ApoB dan hs-CRP). Hasil penelitian menunjukkan dari 45 subjek, usia rata-rata adalah $41,69 \pm 5,69$ tahun, dan rata-rata BMI adalah $33,09 \pm 5,05$ (Obesitas I). ADMA juga ditemukan berkorelasi secara signifikan dengan parameter FPG, HbA1c, dan TG [$r = -0.506$, $p = 0,001$; $r = -0,334$, $p = 0,013$, dan $r = -0,315$. $p = 0,017$, masing-masing]. Pada obesitas, ADMA berkorelasi signifikan dengan parameter risiko kardiovaskular: FPG, HbA1C, dan TG.

Kata Kunci: ADMA, Obesitas, faktor risiko kardiovaskular

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1 Introduction

Asymmetrical dimethylarginine (ADMA) is an endogenous inhibitor of nitric oxide synthase (NO) which appears as a risk marker for various disease conditions including end-stage kidney failure [1], liver failure [2], heart failure [3], diabetes [4], pre-eclampsia [5], and atherosclerotic [6]. It has been observed that ADMA is positively correlated with NO serum concentration and body mass index (BMI) [7].

Inflammation measured by C-reactive protein (CRP) is another strong risk marker for predicting cardiovascular death and complications including inflammatory diseases [8], sepsis [9], lung disease [10], and coronary heart disease [11]. The interaction between ADMA and CRP is a problem of cardiovascular disease because both ADMA and CRP factors are involved in endothelial dysfunction in humans [12].

Obesity increases the risk of morbidity due to hypertension, dyslipidemia, T2DM, coronary heart disease (CHD), stroke, gallbladder disease, osteoarthritis, sleep apnea, respiratory disorders, and certain types of cancer. Obesity is also associated with an increased risk of all causes of death due to cardiovascular disease (CVD) [13]. Obesity is caused by abnormal or excessive fat accumulation due to metabolic disorders [14]. According to previous research, the main determinant of obesity is insulin resistance which is associated with endothelial dysfunction [15]. Obesity can trigger the activity of tumor necrosis factor in α pro-inflammatory cytokine, which then inhibits the insulin receptor substrate 1 in the insulin signaling pathway [16].

Based on several studies, ADMA has a positive correlation with cardiovascular risk factors in prediabetes [17], angina pectoris [7], IGT, and obesity [18]. Therefore, the aim of this study was to investigate the correlation between ADMA and anthropometric, glucose, lipid, and inflammatory parameters in obesity.

2 Method

The study design was a cross-sectional study by recruiting 45 nurses at H. Adam Malik Hospital aged 30-55 years who met the criteria for obesity [19] and signed an informed consent form. Subjects were excluded from the study if they had secondary illness or obesity that could affect markers of metabolic disorders, lipid profiles, and inflammations such as pregnancy or lactation, acute infection, anemia, menopause, diabetes or hypertension, cardiovascular disease, chronic kidney disease or liver dysfunction, smoked, consumed corticosteroids, estrogen, beta-adrenergic receptor agonists, nitrates, or other vasodilator agents [20]. Venous blood samples were collected from the subjects in the morning after 10-12 hours of fasting combined with ethylenediaminetetraacetate (EDTA) containing heparin, then centrifuged.

2.1 Biochemical Analysis

Serum glucose levels, HDL cholesterol (HDL-C), and triglycerides (TG) were measured by the enzymatic colorimetric method while Apo-B and hs-CRP levels were measured by the immunoassay method with Hitachi Modular analyzer using the Roche Diagnostic kit. Insulin levels were measured by the chemiluminescence immunoassay method using the DPC Immulite-I analyzer (Diagnostic Products Corp, Los Angeles, CA, USA) kit.

The HbA1c values were measured using the High-Performance Liquid Chromatography (HPLC) method which was in accordance with the American Diabetes Association standard [21]. ADMA levels were examined using ELISA method with a normal range of 0.4-0.75 $\mu\text{mol/L}$ (80-150 ng/mL) [22]. The HOMA-IR formula = [(fasting glucose serum (mmol / l) x fasting insulin ($\mu\text{U} / \text{ml}$) / 22,5] was used to determine the index of insulin resistance [23].

2.2 Statistical Analysis

The mean and standard deviation were summarized as descriptive statistics. The Shapiro-Wilk test was used to determine whether a variable was normally distributed. The parametric test was performed on variables with normal distribution, whereas the nonparametric test was performed on variables with abnormal distribution. Furthermore, the Pearson and Spearman test was used to evaluate the correlation between variables according to the variable distribution. $P < 0.05$ was accepted as an indication of statistical significance. SPSS for Windows 22.0 was used for the statistical analysis.

3 Results

From the 45 obese patients who met the inclusion criteria, the average age was 41.69 ± 5.69 years, and the average BMI was 33.09 ± 5.05 (Obesity I).

Table 1. shows the characteristics of the research subjects in terms of anthropometric, glucose, lipid, inflammatory parameters in obesity, while Table 2. shows the correlation analysis between ADMA and the subject parameters. There was a significant correlation between the levels of ADMA and fasting blood glucose (FBG), HbA1c, and TG.

Table 1 Baseline Characteristic of Obesity Subjects

Parameters	Total (mean±SD); n=45
Age (years)	41.69±5.69
Body weight (Kg)	78.79±13.26
BMI (kg/m ²)	33.09±5.05
WC (cm)	96.34±9.33
ADMA (umol/l)	0.82±0.13
FPG (mg/dl)	86.00±10.94
PPG (mg/dl)	109.84±28.56
HbA1C (%)	5.56±0.56
Fasting Insulin (μIU/mL)	9.52±7.32
HOMA-IR	1.24±0.91
LDL-C (mg/dl)	137.51±33.51
HDL-C (mg/dl)	47.06±12.84
TG (mg/dl)	151.22±57.31
sd-LDL (mg/dl)	1.34±0.26
ApoB (g/L)	104.31±18.41
hs-CRP (mg/L)	3.64±2.38

Abbreviations: BMI, body mass index; WC, waist circumference; ADMA, asymmetric dimethylarginine; FPG, fasting plasma glucose; PPG, postprandial plasma glucose; HbA1c, glycosylated hemoglobin; HOMA-IR: homeostasis model assessment of insulin resistance;; LDL-C, low density lipoprotein cholesterol; HDL-C, high density lipoprotein cholesterol; TG, triglycerides; ApoB: apolipoprotein B; sd-LDL: small dense-LDL; CRP, C-reactive protein;

In Table 2, After 12 weeks of lifestyle modification, there was decrease significantly on BW, BMI, WC, SBP, and chemerin in both groups. There was no decrease significantly of chemerin on both groups.

Table 2 Relationship Between ADMA and Anthropometry, Glucose, Lipid, and Inflammation Parameters

Parameter	r	P
Age (year)	-0.057	0.356
Body weight (Kg)	-0.056	0.407
BMI (kg/m ²)	-0.117	0.445
WC (cm)	-0.100	0.256
FPS (mg/dl)	-0.506	0.001*
PPS (mg/dl)	-0.230	0.064
HbA1C (%)	-0.334	0.013*
Fasting Insulin (μIU/mL)	-0.102	0.255
HOMA-IR	-0.225	0.069
LDL-C (mg/dl)	-0.149	0.165
HDL-C (mg/dl)	0.154	0.157
TG (mg/dl)	-0.315	0.017*
sd-LDL (mg/dl)	-0.042	0.392
ApoB (g/L)	-0.168	0.135
hs-CRP (mg/L)	-0.059	0.351

Abbreviations: BMI, body mass index; WC, waist circumference; FPG, fasting plasma glucose; PPG, postprandial plasma glucose; HbA1c, glycosylated hemoglobin; HOMA-IR: homeostasis model assessment of insulin resistance; LDL-C, low density lipoprotein cholesterol; HDL-C, high density lipoprotein cholesterol; TG, triglycerides; ApoB: apolipoprotein B; sd-LDL: small dense-LDL; CRP, C-reactive protein;

* p<0.05.

4 Discussion

ADMA is believed to be a mediator that affects the risk of atherosclerosis. Several clinical studies have shown that increased ADMA is present in the conditions of chronic kidney

insufficiency, dyslipidemia, hypertension, diabetes mellitus, and hyperhomocysteinemia, and other conditions [24]. The presence of cardiovascular disease risk factors, especially atherosclerotic disease will induce functional and morphological changes in endothelium, become easily inflamed, thrombosis, and vasoconstriction [25]. The dysfunctional endothelium can be detected by an imbalance between widening and constricting factors, procoagulant factors, and anticoagulant factors which stimulate and inhibit the development and proliferation of cells [26].

Other clinical evidence also supported that increased plasma ADMA was associated with decreased NO synthesis [27]. Plasma ADMA levels can change rapidly in response to changes in the risk factors. In diabetic patients, a few hours after high-fat eating, plasma ADMA level increases, and vasodilation is reduced [28]. In low body mass index (BMI) condition, each 0.1 $\mu\text{mol/L}$ increase in the plasma ADMA level was associated with an increased risk of acute myocardial infarct (AMI) with HR (95% CI) 1.21 (1.08-1.35) and cardiovascular death 1.30 (1.13-1.49) [29]. ADMA level was 0.40-0.77 $\mu\text{mol/L}$ for the entire population, 0.41-0.79 $\mu\text{mol/L}$ for men, 0.38-0.73 $\mu\text{mol/L}$ for women under 45 years old, and 0.41-0.84 $\mu\text{mol/L}$ for women above 45 years old [29]. Past studies showed that plasma ADMA levels were higher in obesity [30]. In this study, ADMA levels were $0.82 \pm 0.13 \mu\text{mol/L}$.

Based on several previous studies, plasma ADMA levels were associated with the risk of AMI and cardiovascular death [7], unchanged with weight loss in obesity [31], hypertension and insulin resistance [32], resistance insulin at the beginning of diabetes [33], HOMA-IR in prehypertension [34], BMI in overweight [35], and HOMA-IR in obesity [36]. In this study, ADMA had a significant correlation with FPG, HbA1c, and TG parameters [$r = -0.506$, $p = 0.001$; $r = -0.334$, $p = 0.013$, and $r = -0.315$, $p = 0.017$, respectively] in obesity.

5 Conclusion

The association between ADMA and increased cardiovascular risks was related to glucose metabolism, lipid, and insulin resistance with various unknown mechanisms. Thus, further and extensive research should be done to determine the role of ADMA in the risk of cardiovascular disease.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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